

What is claimed is:

1. An electrochemical cell comprising an anode electrode and a cathode electrode housed inside a casing and activated with an electrolyte, wherein one of the anode electrode and the cathode electrode is connected to a terminal lead insulated from the casing by a glass-to-metal seal, the improvement is the glass-to-metal seal comprising:

the glass-to-metal seal having an insulating glass extending between and sealed to a support portion of the casing and the terminal lead, wherein the insulating glass has a first coefficient of thermal expansion which is less than a second coefficient of thermal expansion of the terminal lead and wherein the second coefficient of thermal expansion is less than or substantially similar to a third coefficient of thermal expansion of the casing support portion.

2. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion is significantly less than the second coefficient of thermal expansion.

3. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion and the second coefficient of thermal expansion differ by more than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

4. The electrochemical cell of claim 1 wherein second coefficient of thermal expansion and the third coefficient of thermal expansion differ by less than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

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5. The electrochemical cell of claim 1 wherein the second coefficient of thermal expansion and the third coefficient of thermal expansion differ by more than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

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6. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion ranges from about $6.3 \times 10^{-6}/^{\circ}\text{C}$ to about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion ranges from about $9.4 \times 10^{-6}/^{\circ}\text{C}$ to about $11.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion ranges from about $9.5 \times 10^{-6}/^{\circ}\text{C}$ to about $19 \times 10^{-6}/^{\circ}\text{C}$.

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7. The electrochemical cell of claim 1 wherein the insulating glass is selected from the group consisting of Cabal-12 and TA-23, the terminal lead is selected from the group consisting of 446 SS, 29-4-2 SS and a titanium alloy of grades 1 to 5 and 9, and the casing support portion is selected from the group consisting of 304L SS and a titanium alloy of grades 1 to 5 and 9.

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8. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is about $11.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

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9. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is about $9.4 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

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10. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $9.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

11. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $9.5 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

12. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $10.8 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

13. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.3 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $11.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

14. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.3 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $9.4 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

15. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.3 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is

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about $9.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

16. The electrochemical cell of claim 1 wherein
5 the first coefficient of thermal expansion is about $6.3 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is about $9.5 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

10 17. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion is about $6.3 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is about $10.8 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $19 \times 10^{-6}/^{\circ}\text{C}$.

15 18. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is about $9.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
20 expansion is about $9.7 \times 10^{-6}/^{\circ}\text{C}$.

19. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
25 about $9.5 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $9.7 \times 10^{-6}/^{\circ}\text{C}$.

20. The electrochemical cell of claim 1 wherein the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
30 about $10.8 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $9.7 \times 10^{-6}/^{\circ}\text{C}$.

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21. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $9.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $9.5 \times 10^{-6}/^{\circ}\text{C}$.

22. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $9.5 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $9.5 \times 10^{-6}/^{\circ}\text{C}$.

23. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $10.8 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $9.5 \times 10^{-6}/^{\circ}\text{C}$.

24. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $9.7 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $10.8 \times 10^{-6}/^{\circ}\text{C}$.

25. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is
about $9.5 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal
expansion is about $10.8 \times 10^{-6}/^{\circ}\text{C}$.

26. The electrochemical cell of claim 1 wherein
the first coefficient of thermal expansion is about $6.5 \times 10^{-6}/^{\circ}\text{C}$, the second coefficient of thermal expansion is

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about $10.8 \times 10^{-6}/^{\circ}\text{C}$ and the third coefficient of thermal expansion is about $10.8 \times 10^{-6}/^{\circ}\text{C}$.

27. A glass-to-metal seal, which comprises:

- 5 a) an insulating glass;
 b) a terminal lead; and
 c) a support, wherein the insulating glass
 extends between and seals to the terminal
10 lead and the support surrounding the
 insulating glass, and wherein the
 insulating glass has a first coefficient
 of thermal expansion which is less than a
 second coefficient of thermal expansion
15 of the terminal lead and wherein the
 second coefficient of thermal expansion
 is less than or substantially similar to
 a third coefficient of thermal expansion
 of the support.

20 28. The glass-to-metal seal of claim 27 wherein
 the first coefficient of thermal expansion is
 significantly less than the second coefficient of
 thermal expansion.

25 29. The glass-to-metal seal of claim 27 wherein
 the first coefficient of thermal expansion and the
 second coefficient of thermal expansion differ by more
 than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

30 30. The glass-to-metal seal of claim 27 wherein
 second coefficient of thermal expansion and the third
 coefficient of thermal expansion differ by less than
 about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

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31. The glass-to-metal seal of claim 27 wherein the second coefficient of thermal expansion and the third coefficient of thermal expansion differ by more than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

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32. A method for providing an electrochemical cell comprising the steps of:

- a) providing an anode electrode and a cathode electrode in electrical association with each other housed inside a casing and activated with an electrolyte;
- b) connecting one of the anode electrode and the cathode electrode to a terminal lead;
- c) connecting the other of the anode electrode and the cathode electrode to the casing;
- d) electrically segregating the terminal lead from the casing by the provision of an insulating glass extending between and sealing to the casing and the terminal lead, wherein the insulating glass has a first coefficient of thermal expansion which is less than a second coefficient of thermal expansion of the terminal lead and wherein the second coefficient of thermal expansion is less than or substantially similar to a third coefficient of thermal expansion of the casing.

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33. The method of claim 32 including providing the first coefficient of thermal expansion being significantly less than the second coefficient of thermal expansion.

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34. The method of claim 32 including providing the first coefficient of thermal expansion and the second coefficient of thermal expansion differing by more than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

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35. The method of claim 32 including providing the second coefficient of thermal expansion and the third coefficient of thermal expansion differing by less than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

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36. The method of claim 32 including providing the second coefficient of thermal expansion and the third coefficient of thermal expansion differing by more than about $2.0 \times 10^{-6}/^{\circ}\text{C}$.

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